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ABSTRACT

Presented is the SOCRATES (Synchronized Objectives and Competency Rated Activities Teacher Education System) model for preservice education for secondary school science teachers at the University of Toledo (Ohio). Separate courses have been replaced with a sequence of modular-based learning experiences designed to develop each student's competencies progressively over a three-quarter period culminating with a full-time (16 credit hour) student teaching encounter. Instructional teams composed of faculty specializing in learning foundations, educational measurement, and instructional methods for different subject fields work together in guiding students through this sequence. The three-quarter professional sequence may be taken any time during a student's junior and senior years. (Author/PEB)

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S O C R A T E S

Synchronized Objectives and Competency Rated Activities Teacher Education System

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SOCRATES

Undoubtedly the title of this paper will remind you of one of the great teachers of all times. However, I would like to have you consider it an acronym for Synchronized Objectives and Competency Rated Activities Teacher Education System which depicts the new secondary science teacher education program embodied within the Competency-Based Teacher Education (CBTE) program of the College of Education (1) implemented last fall.

Previously, the secondary science teacher education program consisted of four foundations courses, science and a minor subject field methods courses, and student teaching taken during the junior and senior years. As characteristic of most traditional teacher education programs, the courses were distinct with the foundations series generally preceding the methods courses and student teaching. Each course was taught by and reflected the specific views and interests of a single instructor. This resulted in a non-coordinated and fragmented program.

With implementation of CBTE several changes have been effected in the secondary science program and its accompanying instructional process. The separate courses have been replaced with a sequence of modular-based learning experiences designed to develop each student's competencies progressively over a three quarter period culminating with a full-time 16 credit hour student teaching encounter. During the first and second quarters students are enrolled for eight credit hours each in Secondary Teaching and Learning I and II (see Table 1). Instructional teams composed of professors specializing in learning foundations, educational measurement, and instructional methods for different subject fields work together in guiding students through the professional sequence of modules. This provides students with opportunities to continuously interrelate different components of the

TABLE 1

Secondary Science Teacher Education Programs

Professional Education Sequence			
Before CBTE		After CBTE	
Human Growth and Development	3	Secondary Teaching and Learning I	8
Learning and Individual Differences	3	Secondary Teaching and Learning II	8
The Public School Curriculum	3	Student Teaching	16
Methods in Science Teaching	3	Total Quarter Hours	32
Methods in Minor Teaching Field	3		
Educational Theory and Sociological Foundation	4		
Student Teaching	15		
Total Quarter Hours	34		

teaching-learning process rather than examine separate aspects in different courses.

The SOCRATES model represents an organized series of modular-based student activities in the three quarter professional sequence taken any time during the junior and senior years (see Table 2). As they proceed through different phases of the sequenced activities, secondary science students conduct an analysis of the instructional environment, organize an instructional program, prepare for effective instruction, implement and assess their instructional program during an instructional internship

TABLE 2

SYNTHESIS

Synchronized Objectives and Competency Rated Activities Teacher Education System

FIRST QUARTER Secondary Teaching and Learning I		SECOND QUARTER Secondary Teaching and Learning II		THIRD QUARTER Student Teaching	
A ANALYSIS OF INSTRUCTIONAL ENVIRONMENT	B ORGANIZING AN INSTRUCTIONAL PROGRAM	C PREPARING FOR EFFECTIVE INSTRUCTION		D INSTRUCTIONAL INTERNSHIP	E SYNTHESIS AND FUTURE PROSPECTIVES
Study of Student Behaviors Study of School Environment Observation of Teaching Behaviors	Planning a Sequence of Learning Experiences Review and in Depth Study of Science Content Specifying Instructional Objectives Assessing Student Accomplishment	Pre Analysis of Teaching Behavior Instructional Programs - Science: Survey and Critique Aids for More Effective Instruction Practice in Instructional Strategies and Techniques	Examination of Programmed Instruction and Computer Assisted Instructional Materials Planning a Laboratory Program Legal Responsibilities Of Science Teaching	Self Analysis of Science Teaching	Job Interviews Completing Credentials Certification Procedures
8 hours		8 hours		16 hours	

student teaching), and conclude their professional education sequence with a focus on future prospectives. Several modules have been developed which concentrate on specific aspects of each phase of the model. These include modules developed by educational foundations specialists which concentrate on basic principles, generic concepts, and general skills bearing on the teaching-learning process in secondary schools. Other modules developed by the science education instructor guide science students through activities designed to apply the basic principles, generic concepts, and general skills to specific areas of science teaching. To correlate the modules, the science education instructor joins with educational foundations instructors to guide secondary science teaching majors through synchronized objectives directly applicable to the students major and minor teaching fields (see Table 3).

A prominent feature of the University of Toledo CSTE program is its concentration on field-(school) based experiences (2) to mediate the various objectives. Science education students under the SOCRATES model spend substantial segments of time studying the teaching-learning process in both urban and suburban school sites (see Table 4). While mastering fundamental terminal objectives, secondary science majors concurrently participate in local schools to complete related objectives which request them to analyze the instructional environment (3), organize a science instructional program (4) with a local school teacher, and prepare effective instructional strategies (5) to implement the science program during student teaching. When they enter student teaching, the pre-service education majors have had numerous occasions to become familiar with their cooperating school. They have investigated the nature and function of the school system, the specific features and scope of its academic program especially in science, and the

TABLE 3

SCOPATE

Educational Foundations vs. Science Education Input

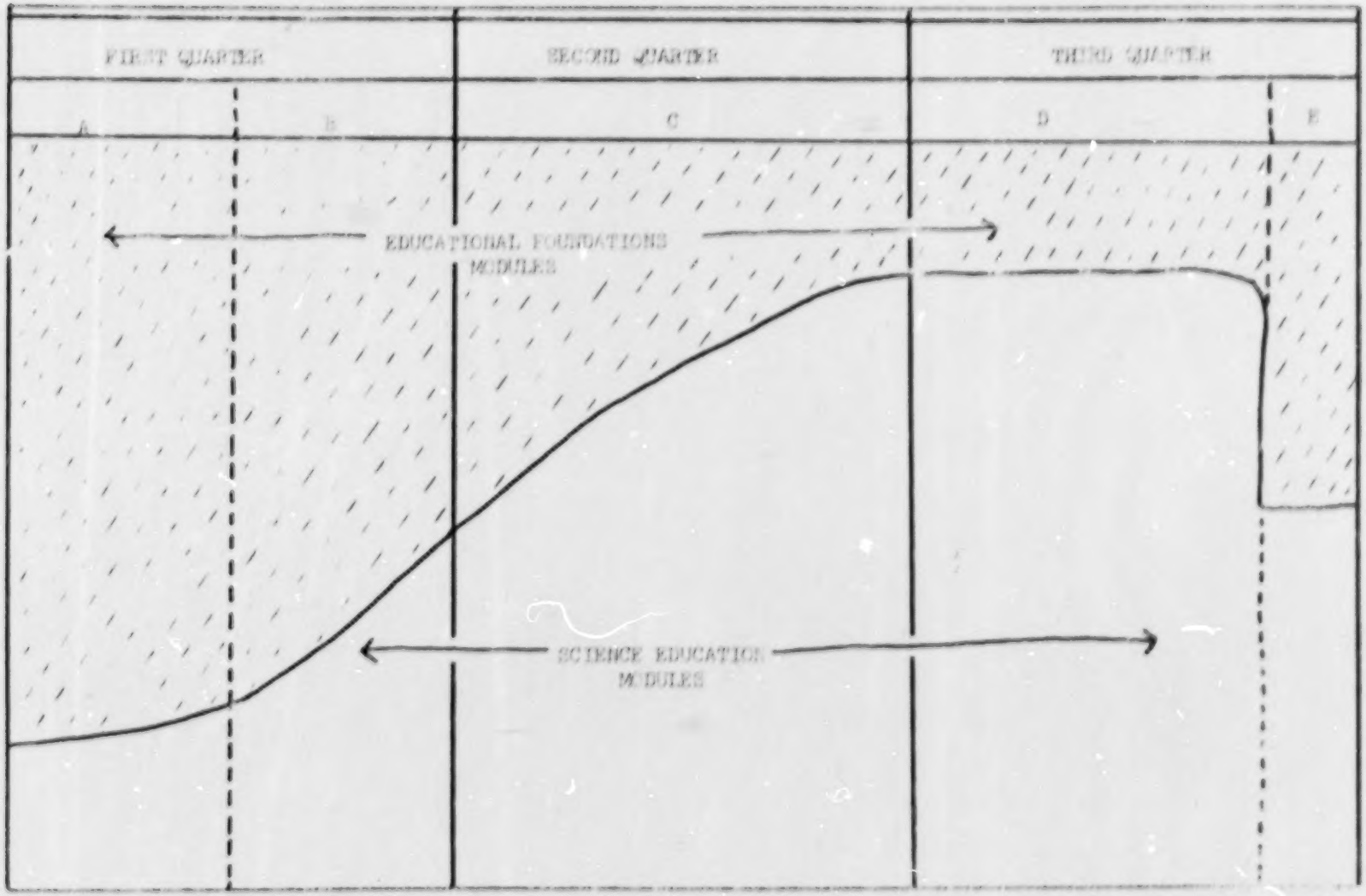
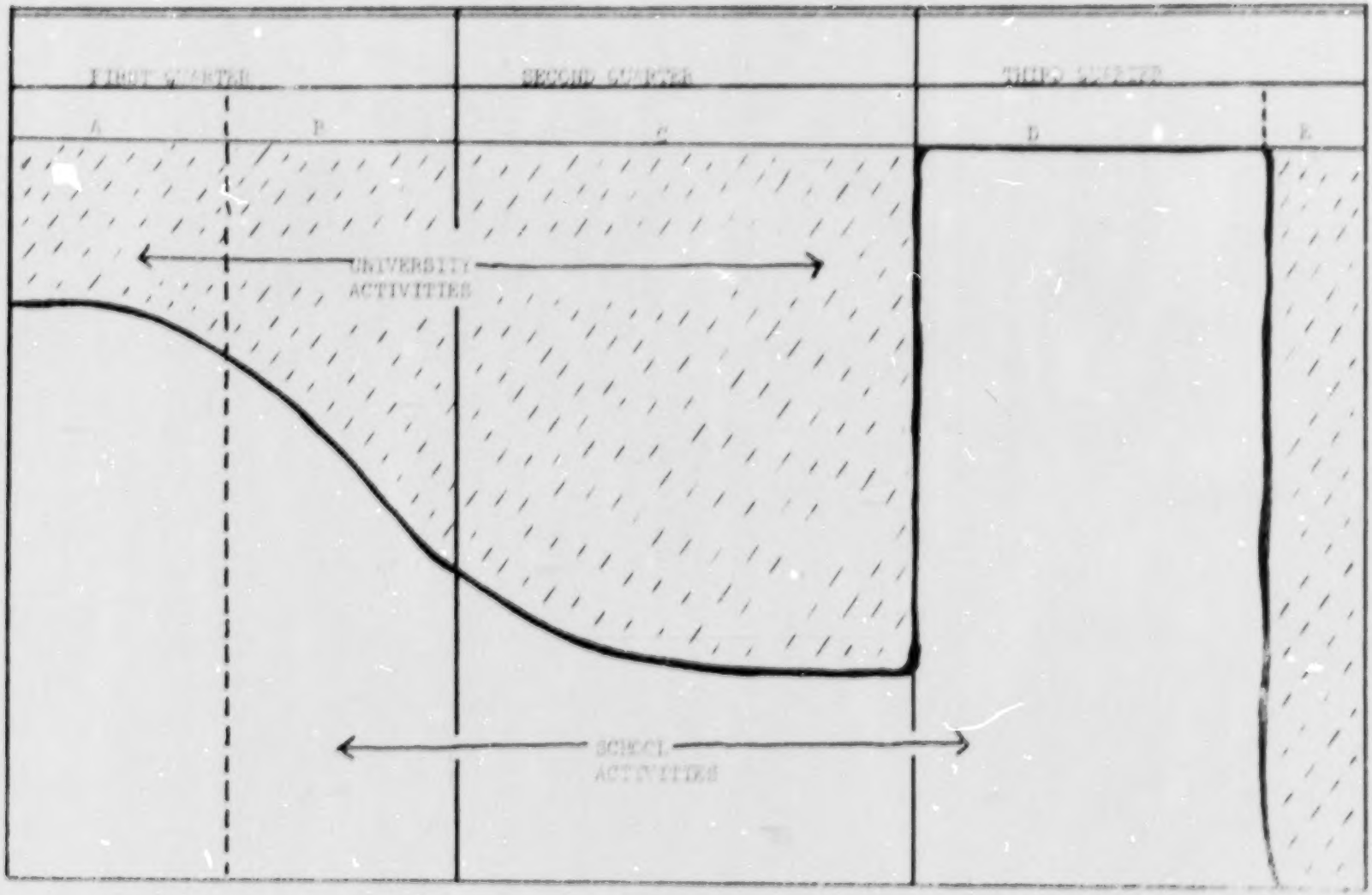


TABLE 4

FIGURE

University vs. School Based Activities



instructional facilities and resources available for science teaching. In addition, they have had an excellent opportunity to establish a working relationship with their potential cooperating teacher for student teaching and to become cognizant of the adolescent behaviors exhibited by students in science classes. A significant benefit of the school-based experiences is their provision to relate educational theory encountered in the university classroom to current practices in secondary school science teaching. Pre-service science teachers are provided a means to gain numerous insights regarding the application and modification of theoretical concepts in teaching-learning to science teaching.

Individual differences of science majors are accommodated in the SOCRATES model in several ways. The modular activities are designed for self-paced instruction; therefore, students may progress through them at their own speed. Preassessment instruments are available for each module which allow students an opportunity to determine their entering competencies before engaging in the instructional process. Students demonstrating mastery of terminal objectives are advanced in the program on an individual rather than a group basis. Consulting with their science education instructor, students complete terminal objectives related to their subject specialty, e.g., biology, chemistry, earth science, physics, or appropriate combinations of each depending on their interest and academic backgrounds. Student field experiences can be completed in schools selected from a wide variety and range of local school environments, both public and private. This provides students with an opportunity to select the type of school for student teaching possessing characteristics similar to one in which they anticipate employment following completion of the program.

Pre-service science teachers, usually juniors, begin their professional sequence with an analysis of the instructional environment of a secondary school (see Table 2, First Quarter, Column A). They start with a study of adolescent psychology following a module developed by an educational psychology instructor, and concurrently conduct a study of student behaviors in appropriate science classes of a selected local school using a module developed by the science education instructor. Next they examine the social psychology and social factors involved in schools and return to their schools to study the system and its function. Included is an examination of school policies, attitudes and functions of teachers, administrators, and supporting staff, and identification of facilities and resources available to support science instruction. To conclude their study of the instructional environment secondary science majors learn the Flanders Interaction Analysis verbal behavior system and return to their schools to use it during observations of experienced science teachers in a variety of learning situations. During all aspects of this phase of the program, terminal objectives of modules prescribed by an educational psychology instructor are synchronized with objectives prescribed by the science education instructor. Both instructors are jointly responsible for assessing each student's competency level on the prescribed terminal objectives.

During the second phase of the first quarter science majors organize an instructional program which, hopefully, will be implemented during student teaching (see Table 2, First Quarter, Column B). Consulting with a potential cooperating science teacher, students plan a sequence of learning experiences for the period of time when they will be student teaching. Generally, a course guide or syllabus used by the school forms the basic content sequence. Students then enter into a study of concept identification and development

with a foundations instructor, and concentrate on a succinct review and in-depth study of the science content outlined for the instructional sequence. Joined as a team, a foundations instructor and the science education instructor guide science majors through a study of behavioral objectives and the writing of specific instructional objectives for the instructional program previously prepared. This is followed with modules concerned with tests and measurement in education, and a module directing students to develop specific items for assessing student performances on the instructional objectives previously prepared. Terminal objectives of foundations modules and science education modules are synchronized to promote continuity and reinforcement during the students progress.

In the second quarter of their professional sequence, secondary science majors proceed through a series of modules designed to prepare them to implement effective science teaching strategies and techniques (see Table 2, Second Quarter). Students begin the quarter with a pre-assessment of their science teaching ability. To facilitate this activity, they teach a 10-15 minute lesson to a group of their peers which is video-tape or audio-tape recorded. Immediate feedback is provided to each student by their peers reflecting the quality of the lesson presented. Each student then analyzes the audio or video tape record and develops a summary of strengths and weaknesses related to his teaching behavior. Next the science majors launch into a concentrated study of current science curricula available in their major and minor teaching fields, focusing on the instructional styles and content presented. This is followed with modules prepared by educational technology instructors guiding them in a basic study of instructional media and technology, and a concurrent survey and study of instructional media and technological resources available in their local schools for teaching science as directed by the science education instructor. Next, the students are placed

through a concentrated study of instructional strategies and techniques by a team of foundations instructors and the science education instructor. Study and practice is conducted on the basic teaching styles necessary for effective science teaching in a variety of situations. Included is an examination of lecturing, teacher demonstrations, group discussions, discovery oriented instruction and individualized instruction all viewed from an inquiry learning approach. Science education majors conclude the quarter with modules directing them through an examination of programmed instruction and computer assisted instruction materials, planning a science laboratory program, and reviewing the legal responsibilities of science teachers.

The third quarter is devoted to a full-time student teaching experience during which students utilize a module to guide them in periodic self-analyses of their science teaching. This analysis procedure includes both subjective and objective components, and is primarily concerned with examining teacher and student classroom behavior in relation to the planned instructional program. Collaboration between the science education instructor and local school cooperating science teacher facilitate a continuous and progressive assessment of the student teacher's progress and growth. Because science majors are prepared to begin student teaching without the one to two week observation period, these students have time at the end of the quarter to conduct a synthesis of their teaching and instructional program, to engage in simulated job interviews, and to complete professional credentials and certification procedures.

Secondary science majors completing the professional sequence portrayed by the SOCRATES model are provided progressive and sequential opportunities to develop terminal competencies through a variety of experiences in different contexts during the three quarters. For example, an understanding

their competency to assess student behaviors and progress, science majors begin during the first quarter with modules focusing on a study of adolescent behaviors at the university and concurrently observe student behaviors in science classes of local schools. This is followed with modules pertaining to tests and measurement, and assessing student performance resulting from instruction. Through the second and third quarters assessment of student behaviors and progress is again examined during practice of teaching strategies and student teaching (see Table 5). Referring to another example, developing the competency for appropriate and effective incorporation of educational technology in learning experiences is begun during the first quarter when science majors observe different science teaching situations and note the presence or absence and effective use of educational media. It is continued in the second quarter as they study aids toward more effective instruction and complete the instructional media modules. Their competency is further developed and reinforced during the second and third quarters when the students engage in practice teaching strategies and student teaching. In a similar manner other terminal competencies are developed throughout the program.

The SOCRATES model provides a teacher education system possessing an organized, but flexible modular series of synchronized activities and learning experiences guiding science education majors through their professional teacher education sequence. Students simultaneously examine educational theory and its application to learning science as it occurs in schools. In essence they are engaged in a process oriented teacher education program. Hopefully, the system will provide a model for the development of outstanding teachers as implied by the acronym.

TABLE 5

SOCRATES

Progressive Development of Terminal Competencies

FIRST QUARTER		SECOND QUARTER	THIRD QUARTER		TERMINAL COMPETENCIES
A	B	C	D	E	
*	*	*	*		1. Assessment of Student Behaviors and Progress.
*	*	*	*		2. Appropriate and Effective Utilization of Instructional Strategies and Techniques.
	*	*	*		3. Specification of Instructional Objectives and Terminal Student Competencies.
*		*	*		4. Evaluation of Instructional Effectiveness.
		*	*		5. Application of Learning Theories with Consideration for Intellectual Development.
	*	*	*		6. Development of Student Competencies in Planned Instructional Sequences.
		*	*		7. Appropriate and Effective Incorporation of Educational Technology.
		*	*	*	8. Assessment of School Administrative System and Societal Impact on Instruction.
					9. Others -

* - one or more modules developing the terminal competency.

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